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INTRODUCTION TO A STUDY OF DECISION MAKING

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INTRODUCTION TO A STUDY OF DECISION MAKING

Many social scientists from different disciplines regard human decision making as highly important to their respective fields.[1] Models of choice and problem solving indeed are central to economics, political science, cognitive psychology, administrative theory, management science, systems engineering, and the theory of education. Yet few theorists have studied in detail how human beings in fact go about making decisions and solving problems.[2] It seems most classical and neo-classical decision models continue to be discussed in something of an empirical vacuum.[3]

The present study is an attempt to contribute towards making decision theory a bit more empirical. The overall research strategy has been to:

1. review existing notions and models of human choice behavior;

2. collect and systematize detailed observations of the thinking process of reasonably sophisticated decision makers resolving quite difficult problems;

3. put together a generalizable and empirically testable model of such decision processes;

4. begin to test some of the central propositions of the theory on different and larger samples of decision makers in a "real life" field setting.

The centrality of decision theory

Why do models of choice behavior play such a key role in the social sciences? Let us speculate. Decision making and problem solving is by definition task oriented. A large portion of man's behavior in society is similarly task oriented. A satisfactory theory of decision making should thus provide the conceptual apparatus for describing a wide range of human behavior.

The role of rationality models in social science is further enhanced by the compatibly normative "social engineering" orientation of many behavioral scientists. It may seem obvious to the latter that few research directions promise more immediate usefulness of their results than studies of human resource allocation and decision behavior.

The generality of decision behavior

In what way are task achieving behaviors to be distinguished from non-task oriented behavior? How are we operationally to distinguish decision behavior from "other" types of behavior? Consider three possible answers:

1. There surely exist behaviors that are not task oriented.

2. We might exclude from the domain of decision theory those behaviors which, even if they were task oriented, were not in some sense "rational".

3. If asked, most men would probably deny that most of the time they were engaged in making choices and solving problems.

Yet neither of these reservations are very satisfactory. We can argue, quite reasonably, that few occasions for behaviors are so lacking in motivation or direction that they cannot be viewed <u>as if</u> the actor were indeed task oriented[4]. With regard to the rationality criterion it may suffice to note that in the absence of a prior agreement between the observer and the observed, regarding what are to be the ground rules, or boundary conditions, for the latter's "rationality", the concept will in most instances be empirically unoperational, and thus largely void of precise meaning. Finally, individuals who claim that only rarely are they faced with decisions to be made seem to overlook the extent to which their various behaviors could be described as if they were chosen from a set of conceivably possible courses of action, in response say to current environmental conditions.

Thus neither of the above attributes provide us with a sharp dichotomy for distinguishing decision from non-decision behavior. There will surely be degrees and gradations, yet almost all behavior involves elements of decision making. This does not mean, of course, that there are not alternative ways of theorizing about behavior. We will consider this question next.

Manifest and teleological theories of behavior

Some descriptions of behavior have subjectively valid referents. A theorist's constructs are thus directly "meaningful" to his human subjects, by virtue of the former's identity with, or at least one-to-one correspondence to, symbolic entitites that subjects actually do, or are immediately able to, utilize in their own thinking or information processing. We might call a theory a constructed exclusively from such concepts "teleological".

We can easily imagine other theories of human behavior the concepts in which possess no such necessarily meaningful, direct symbolic, reference to the cognitive processes presumably described by the theories. For more efficient notation below we will label the latter type of theory "manifest".

To illustrate, consider chess playing behavior. Manifest descriptions of chess behavior could conceivably be framed in terms of whatever variables an investigator might be able to dream up, or might have stumbled upon, say in his review of the psychological literature on problem solving. To be more specific, consider variables like "probability of a chess player making a two-square move", "mean length of time per play", "average distance travelled by various classifications of chessmen", "frequency ratio of Pawn to non-Pawn moves", "average information-bit content per move", etc. Neither of these measures have much relevance to a man actually engaged in playing chess. Yet quite reliable and scientifically valid empirical descriptions of chess behavior conceivably could be constructed using such variables, say by means of multiple correlation or factor analysis.

A teleological description of the same behavior should, as indicated, limit the observer's attention to those variables he thought were in some sense "meaningful" to the subjects he was observing. Thus a theorist of chess behavior would initially try to infer what symbolic codes his subjects were using for thinking about moves in the game. The observer might for example note that each of the players was indeed trying to "check the opponent's King", and that variables he considered in trying to do so often included his "control of the center of the chess board", "whether he had isolated or

hanging pieces threatened by the opponent", "what might be the possibility of launching an attack on the King's wing", etc.[5] The theorist's job would then be to explain, e.g. by reference to even more detailed symbolic processes, whatever regularities in behavior he was then able to observe in his subjects,using their codes for events in the problem environment exclusively.

Either mode of explanation may of course be made into just as "scientific" a theory, i.e. as measurement reliable and predictively valid a description,as a theorist's scientific ambitions would care to prescribe. Yet a teleological approach to the description of behavior may in the long run yield more parsimonious, conceptually better integrated, and more easily implemented theories of social behavior than can be expected from adherents of the less restricted manifest strategy -- for the following obvious reason: A teleological orientation limits its theorist to his subjects' conceptual vocabulary as the population from which to select variables and relationships to study; whereas the manifest method leaves a theorist free to make up, or have dubious mass "statistical" analyses make up for him, any number of ad hoc variables and relationships with which to describe each new batch of data that comes across his desk.

Focus of this study

Decision making studies have quite naturally adopted the teleological approach to social theorizing.[6] Most models of choice behavior do utilize variables that bear direct conceptual correspondence to the coding schemes that humans are presumed to utilize when thinking about choices they might be faced with. Yet it seems we had to give up our search for descriptive attributes that would discriminate decision from non-decision behavior. A priori

it appears that most any form of human behavior is a fair target for study by theorists suitably armed with a generalizable model of decision making.[7]

Thus it will obviously not suffice if we, as social theorists, merely state that we are interested in studying human decision making behavior. In order to be able to focus our research interest, even minimally, we shall forthwith have to specify more precisely what type of decision behavior we wish to explore. The answer, as far as this study is concerned, is that we want to focus on non-repetitive, highly unprogrammed, personally critical, explicit choice behavior by individuals who were making unique decisions in a complex field situation. But before we set out to review the available models, findings, and theoretical notions that may help us formulate a working theory of the latter type of decision making, let us examine breifly the meaning of each of the six choice attributes in the preceding sentence.

Non-Repetitive Choice

A non-repetitive choice is one identified by the decision maker (Dm) as belonging to a class of decision problems that he has rarely, if ever, faced before, and which he at time of choice expects not to have to face again within his current planning horizon.

One hypothesis, which would make this descriptive attribute irrelevant, is that the theory of non-repetitive choices will be identical with a theory of repetitive choices. Yet there seem to be two features of repetitive decision making that we would not expect to observe in non-repetitive situations:

a. Dm will successively attempt to program his decision making, devoting quite a bit of time and computational resources to formulating explicitly, trying out, and then modifying rules for making his serial decision more automatic, i.e., computationally less costly, over a series of repititions.

b. Dm will have available to him a memory of past experiences that is immediately applicable to his present choice problem. He will also expect to receive immediate feedback of information regarding how he is presently doing. Both which conditions will enable Dm:

   i. to respond in a reflexive, pattern responsive manner to his task environment, and

   ii. to commit himself more readily if only partially at each trial, relying on his opportunity to correct errors on future trials.

Unprogrammed choice

We speak of a decision as being highly programmed if Dm applies an explicit, special-purpose decision rule for making the choices he is called on to make. Faced with what is for him a highly programmed problem all Dm needs to do in order to make decisions is to estimate and "plug into" his rule's decision variables the current state of his task environment.[8] The reader is surely already familiar with the notable success achieved by recent attempts to simulate by digital compter the quite elaborate, but highly programmed, choice behavior of sophisticated industrial and professional decision makers.[9]

Conversely, when Dm has only the foggiest notion about what to do about a given problem, where his search for solution is guided merely by quite general and weak heuristics, we would classify his decision behavior as being highly unprogrammed.

Critical choice

A decision is critical if Dm has an unusually highly valued personal stake riding on the outcome of his choice. "Unusually high" is obviously a subjective measure, in general different for each Dm we might encounter, and even varying for a single Dm over longer periods of time. One way to measure the importance a Dm attaches to a given choice is simply to ask him to rate the decision context on a questionnaire scale, e.g.:

Critically Important	Highly Important	Quite Important	Somewhat Important
Not particularly Important	Quite Unimportant	Of no consequence whatever	

We could then accept as "critical" those situations receiving either of say the two or three top-most ratings.

We might hypothesize that Dm's decision process when resolving more critical problems will be more deliberate, and thus more easily accessible to observation, than his short cut deliberations about less important problems. There is some doubt whether it is even possible to simulate critical decision problems in the laboratory, hence whether most of our knowledge about critical human choice behavior will not have to come from observations in less well controllable field settings.

Explicit Choice

Above we considered the argument that most goal oriented behavior could be described in decision-theoretical terms, <u>as if</u> the subject were running through series of deliberate choices that in turn controlled his actions.[10] Yet it may be useful to differentiate <u>a.</u> situations in which Dm is <u>i.</u> less aware that he is indeed making choices among alternatives, or <u>ii.</u> if aware that he is faced with choice, is for some reason pre-committed to following a given course of action, from <u>b.</u> situations in which Dm is more explicitly aware that he is about to reject alternatives, possessing as well a wider range of discretion regarding the final nature of his decision.

The everyday meaning of "decision making" clearly entails what we have here labeled explicit choice. Yet a theory of explicit choice in order to be complete should also specify the circumstances under which a Dm will indeed recognize that he is about to exercise his discretionary powers of selection.
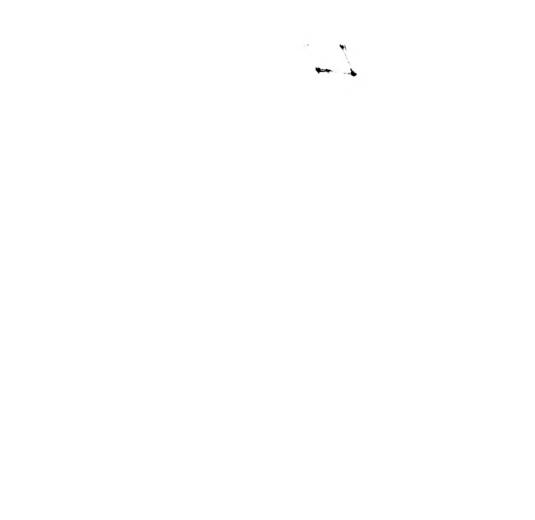
Individual choice

One might study individual choice behavior for two reasons: We might well want to learn more about individual decision makers per se. Or else we may really want to know more about the behavior of groups, organizations, and societies, but believe that the nature of the latter can be explored by aggregating our knowledge about collectivities of individuals. Simon has for example proposed that "the basic features of organization structure derive from the characteristics of human problem solving processes and rational human choice".[11] This position does of course not imply that organizational and

individual decision processes are in any phenomenological sense identical.
It simply assumes that individual role incumbents play a predominant role in
organizational choice behavior, particularly with respect to highly unpro-
grammed, innovative, or poorly structured problem solving -- such that a neces-
sary if not sufficient ingredient for understanding organizational structure
and processes is an adequte theory of individual choice.

Our methods for studying organizations, being as weak as they are, makes
it seem somewhat optimistic for us to launch investigations into organizational
choice processes per se, without first having gained a better understanding
than we have at present of the individual building blocks that we would thus
be trying to aggregate. Yet it is instructive to consider some of the "group"
and "organization" variables that we would have to take into account in order
to modify whatever theory of "individual choice in isolation" that we might
develop:

1. Parallel processing. Organizations work on several things at once.
Individuals are more nearly sequential problem solvers. Parallel processing
would require us to amend a solitary choice theory with considerations deriving
from a division of labor among organizational sub-units, i.e. from the need
to take into account the modifications that planning, coordination, and communi-
cation among separate individuals working on the same problem impose on a theory
of organizational choice.

ii. Organizational influence processes. An individual working alone
differs from one working with others also to the extent that the latter has
to work "through other people", being in turn subject to their influence and
expectations on him during the solution of a common problem. Thus other people's

motivations and organization sub-goals must enter into our specification of any given role incumbent's decision making objectives and constraints. Similarly, we expect that strictly problem irrelevant considerations, like personal power politics and career survival tactics, would present potent sources of noise for any theory of intra-organizational decision making that purported to present problem solving as an orderly, entirely task oriented sequence of choices flowing impersonally through the layers of an organization.

iii. Formalized information processes. Organizational rules of procedure serve not merely to explicate the programs used by individuals for making repetitive decisions. They also often define the boundaries of most incumbent Dms' problem solving discretion. Thus we can again expect that an organizational context serves to limit a Dm's choice behavior in ways not predictable from individual considerations alone. The fact that information codes and information storage systems tend to get standardized in formal groups provides yet another reason for expecting that organizational problem solving will be a much more structured, and perhaps less innovative, affair than for the case of individual decision makers working alone.

Complex task environment

We will briefly consider the last of the six attributes of choice we employed initially in order to focus our research attention in the field of decision making. A simple task environment is defined as one in which Dm has access to, and is able to process in the time available to him, all information relevant to his choice. In a simple task environment Dm will either have available an algorith that guarrantees him a solution, or else it will be within his computational power to chase down all branches of the search tree representing the decision alternatives facing him.

Most "real" task environments are not simple in this sense. In a complex environment an understanding of how Dm searches his decision tree, of how he processes information about the task environment, becomes critical for our ability to predict his final choice -- for the simple reason that Dm will (have to) stop deliberating before he is finished, and thus have to make a "best" decision based on whatever problem information he has been able to collect and analyze up until that point in time. Thus, for complex task environments, a theory of decision making must necessarily become a process theory, i.e. one that simulates certain aspects of Dm's intermediate choice behavior, as well as of his final decision.

The latter type of decision theory obviously contrasts with a pure outcome model which, for sufficiently simple task environments, may well produce accurate predictions of Dm's final choice by operating entirely with the same information that Dm also has available to him at the outset of his search, usually by means of considerably more powerful analytical techniques than direct simulation of Dm's own behavioral information processing routines.

It is instructive to contemplate, in closing, that the distinction between simple and complex task environments provides us with the conceptual key for settling the long raging controversy between the proponents of "optimizing versus "satisficing behavior, whether one or the other is to be considered the explanation of how human beings in fact make decisions.[12] The answer should be obvious to the reader in light of our discussion above.

NOTES AND REFERENCES

1. Consider for example the central role played by decision concepts in the
    following key works: J.M. Henderson and R.E. Quandt, Microeconomic theory,
    New York: McGraw-Hill, 1958; P. Samuelson, Foundations of economic theory
    of the firm, Englewood Cliffs: Prentice-Hall, 1963; R.A. Dahl, Modern
    political analysis, Englewood Cliffs: Prentice-Hall, 1963; E.C. Bonfield
    and J.Q. Wilson, City politics, Cambridge: Harvard and M.I.T. Press,
    1963; H.A. Simon, D.W. Smithburg, and V.A. Thompson, Public administration,
    New York: Knopf, 1950; A.W. Gouldner, Patterns of industrial bureaucracy,
    Glencoe, Ill: Free Press, 1954; J.G. March and H.A. Simon, Organizations,
    New York: Wiley, 1958; W.W. Cooper, H.J. Leavitt, M.W. Shelly II, New
    perspectives in organization research, New York: Wiley, 1964; J.S. Bruner,
    The process of education, Cambridge: Harvard, 1961; G.A. Miller,
    E. Galanter and K. Pribram, Plans and structure of behavior, New York:
    Holt, 1960.

2. Until A. Newell, J.C. Shaw, and H.A. Simon published their pioneering
    study of naive students solving logic theory problems -- "Elements of a
    theory of human problem solving", Psychol. Review, 1958, 65, pp. 151-166
    -- few theorists had studied the processes of human decision making in
    adequate detail. Notable exceptions are A.D. deGroot, Het danken van den
    schaker, Amsterdam, 1946, (Thought and choice in chess, Mouton, 1965);
    R.L. Hall and C.J. Hitch, "Price theory and business behavior", Oxford
    studies in the price mechanism, Oxford, 1951; and J.S. Bruner, J.J.
    Goodnow, and G.A. Austin, A study of thinking, New York, 1956.

3. Examples of largely arm-chair speculations about the nature of rational
    choice are more obvious in the economic literature. See for example
    K.J. Arrow, "Utilities, attitudes, choices, a review note", Econometrica,
    1958, 20, pp. 1-23; or J.S. Chipman, "The foundations of utility,
    Econometrica, 1960, 28, pp. 193-224. For further discussion of the dearth
    of empirical evidence for economic decision theory see R.M. Cyert and J.G.
    March, A behavioral theory of the firm, Prentice Hall, 1963, pp. 4-16.

4. For example, music appreciation is not usually thought of as being parti-
    cularly task oriented. Yet any reasonable description of aesthetics will
    include rules for recognizing and categorizing sensory inputs, permitting
    an afficiando of music to express his subjective judgement (choice) regarding
    the "goodness" to his ears of a given performance; and correspondingly,
    of a painting to his eyes, a poem to his thoughts, etc.

5. A.D. deGroot, op. cit.

6. For a recent review of the field, which illustrates the point, see D.W.
    Taylor "Decision making and problem solving", in J.G. March (ed.)
    Handbook of organizations, Chicago, 1965, pp. 48-86.

7. Consider the extremely wide range of behavior addressed by G.A. Miller,
    E. Galanter, and K. Pribram, op. cit., in terms of such a (GPS) model.

8. See also J.G. March and H.A. Simon, op. cit., pp. 177-179.

9. Obvious examples are F.M. Tonge, "An assembly line balancing procedure,"
    Management Science, 1960, 7, pp. 21-42; or G.P.E. Clarkson, Portfolio
    selection, a simulation of trust investment, Prentice Hall, 1962.

10. G.A. Miller, E. Galanter, and K. Pribram's suggestions constitute
    a   consistent application of this argument, op. cit.

11. J.G. March and H.A. Simon, op. cit. p. 169.

12. See H.A. Simon, "A behavioral model of rational choice", Quatr. J. Econ.,
    1955, 69, pp. 99-118, for a clear statement of the issues in the debate.